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Description

The invention relates to a database system comprising:

- a) a plurality of subsystems each of which is adapted to produce and process one or more types of information;
- b) a bus system; and
- c) a plurality of interfaces respectively coupling the respective subsystems to said bus system,

where

i) each subsystem comprises means for requesting information by including in such a request an indication of the type of information desired, and means for supplying information produced by said subsystem including therein an indication of the type of the produced information;

ii) each interface comprises means for:

- sending a request, via the bus system, for the supply of a particular type of information in case the subsystem belonging to the interface requests information of the said type;
- accepting information produced by the subsystem belonging to the interface, including an indication of the type of the information;
- supplying the bus system with a particular type of information in case the interface, via the bus system, receives from another interface connected to the bus system, a request for the supply of information of the last-mentioned type, if the subsystem belonging to interface produces the information in question;
- accepting from the bus system the information of the type requested by the subsystem belonging to the interface, and supplying the accepted information to subsystem.

A database system of this kind is known from DE-A 31 48 733, which deals with the retrieving and editing of distributed information. This known system has as a main advantage that a processor may share its workload with other processors and that this sharing is organised on the basis of the type of information to be processed upon.

The present invention deals with a system of interlinked subsystems spread out on a ship.

A prerequisite of such a system is that it be operational at any time. This is usually realised by duplicating the entire system, with both systems operating synchronously. This solution, however, has the disadvantage of being rather complicated and therefore very expensive. The life cycle of a database system is generally so long that several revisions of the system are carried through. Moder-

nisation of e.g. one subsystem generally necessitates modification of parts of the database system, because the various subsystems are interdependent. This interdependence is due for instance to the fact that the various subsystems address each other both when requesting and when sending information. The present invention has for its object to solve the indicated problem by isolating the various subsystems from each other to a certain degree, while communication between the subsystems remains possible.

Because subsystems do not address each other, but instead use the type of the information to be sent as a selection criterion, the subsystems are highly independent of each other. A subsystem does not need to "know" which other subsystems there are and is therefore independent of the network configuration. As a result, only the essential parts of the database system need to be duplicated, while the synchronisation of the duplicated subsystem is automatically maintained. It is also possible to add one or more updated subsystems to the network, or to replace subsystems by other subsystems without having to adapt the original subsystems. This, too, is a direct result of the fact that the information type determines whether a subsystem accepts this information.

A subsystem may also produce information which cannot be processed by certain or by all subsystems without causing hindrance to the said subsystems or the interconnecting bus system. Consequently, a subsystem needs to be suitable only for supplying information produced by the subsystem with the accompanying type indication, for requesting the required information of a particular type, and for accepting the information presented. If a bus system is used in the network, it is possible to connect a subsystem via an interface with the bus system to create a database system. The bus system may be of a generally known type.

For this purpose the database system according to the invention is characterised in that:

iii) each interface comprises means for:

- storing, as from the moment the subsystem belonging to the interface makes at least one request for information of a particular type, the information of the above-mentioned type, each time new information of the said type becomes available on the bus system;
- supplying to the bus system, as from the moment the interface receives from the bus system at least one request for the supply of information of a particular type, new information of the said type each time this information is again produced by the subsystem belonging to the interface;

- supplying already accepted and stored information of a particular type to the subsystem belonging to the interface each time the said subsystem requests information of this type.

A cost-effective version of a database system according to the invention will be further explained with reference to the accompanying drawings, in which

Fig. 1 is a possible embodiment of a database system according to the invention;

Fig. 2 is a possible embodiment of an interface; and

Fig. 3 is an example of time-dependent quality information.

Fig. 1 shows a database system 1 according to the invention. It includes a number of subsystems 2a-2n, which are usually not identical. A subsystem 2i is a system which can process and/or produce data. Subsystem 2b is, by way of example, connected to an information-producing unit 3. The information-producing unit 3 may e.g. be carried out as a radar apparatus, an infrared camera, or a sonar apparatus. Subsystem 2c is, by way of example, connected to a terminal 4, at which an operator is engaged. The operator can examine or enter data. Subsystem 2n can e.g. be configured as an independent calculator, which carries out calculations for other subsystems. All subsystems 2a-2n are linked via lines 5a-5n with network 6, which handles the message traffic among the various subsystems.

Communication among the various subsystems is subject to the following rules, among others:

- a subsystem requiring information of a particular type requests network 6 to supply this information;
- when a subsystem produces information, this subsystem supplies the said information and the information type indication to network 6;
- network 6 supplies the information of a particular type to the subsystems requesting the information of the said type when this information is available in the network.

The fact that the subsystems are not aware of each other's presence results in an extremely flexible system, since the message traffic among subsystems is now based on the information type, which renders addressing superfluous. A subsystem therefore does not need to "know" the other subsystems, making the system configuration extremely flexible.

Various possibilities exist to realise a network 6 possessing the required characteristics. For instance, it is possible to have one single processor execute all functions of network 6. Referring to Fig. 1, however, a network will be discussed which

includes several processor-network interfaces 7a-7n. An interface 7a-7n links a subsystem 2a-2n with a bus system 8 belonging to the network by means of lines 5a-5n, 9a-9n and bus taps 10a-10n. Bus system 8 may be of a generally known type. The communication among the various subsystems 2a-2n by means of interfaces 7a-7n is explained with reference to an example: information exchange between subsystem 2i and subsystem 2j. It should be borne in mind that the characteristics described of subsystems 2i and 2j and of interfaces 7i and 7j respectively are present in all subsystems and interfaces respectively.

The subsystems will generally be of different types, while the interfaces are identical. In simple form, the communication will be as follows:

- If the subsystem 2i requires information of a particular type, a request is made via line 5i to interface 7i for the supply of the said information;
- Interface 7i sends, via line 9i and bus system 8, a request to each interface 7j linked to the bus system to supply the said information. To that effect the bus system uses "broadcast".
- Interface 7j stores all the information presented by subsystem 2j via line 5j, together with the information type indication. In this context, subsystem 2j may be provided with facilities to determine whether information produced by the subsystem is of local or global value. Only in the latter case will a subsystem proceed to present information to the corresponding interface;
- In case interface 7j has stored information of a particular type while interface 7i received a request for the supply of information of the said type via line 9j, interface 7j supplies this information to bus system 8 via line 9j;
- In case interface 7i is presented with information of a particular type by bus system 8 while interface 7i has received a request for the supply of the said type of information from subsystem 2i via line 5i, interface 7i accepts the said information. The accepted information can subsequently be presented to subsystem 2i. The presentation of the said information may occur either immediately after reception of the information from bus system 8, or at a subsequent request of subsystem 2i for the supply of information of the type in question. In a special version of the interface, discussed below, a version with a so-called subscription service, the information accepted by interface 7i is transferred immediately to subsystem 2i after the first request of subsystem 2i for the information in question, while subsequently the information accepted by the interface is only supplied to

subsystem 2i at a next request of subsystem 2i.

Thanks to the subscription service, the speed and effectiveness of the database system is considerably improved. For instance, a subsystem may produce information which cannot be processed by any of the subsystems connected to bus system 8 without needlessly loading bus system 8 or another interface. In the latter case, a subscription is not opened so that the relevant information is not supplied to bus system 8.

The communication among the various subsystems 2a-2n by means of the special version of interfaces 7a-7n mentioned above, will be further explained with reference to Fig. 1 and Fig. 2, where Fig. 2 represents the special version of interfaces 7a-7n.

In the further discussion of a random interface 7i, the index i will be omitted (Fig. 2). In case a subsystem 2 produces information with the accompanying information type indication, the complete information will be supplied to interface 7 via line 5. This information is processed by means of an adapter processor 11, of which the corresponding program is stored in a ROM memory 12. All microprocessors present in an interface are interconnected via an internal bus 13, which bus is provided with a system time by means of a clock 14. Last-mentioned process is of such a nature that further operations to be carried out in the interface are simple to implement. The said information is stored in a local database memory 16 via bus 13 under control of a local database manager processor 15. The software of local database manager 15 is stored in a ROM memory 17. If subsystem 2 requests the interface 7 via line 5 to supply the information of a particular type, this request is stored in a subscription memory 19 under control of a subscription processor 18. The software for processor 18 is stored in a ROM memory 20. Information with the corresponding type indication, which is available on bus system 8, is supplied to a bus adapter processor 21 via line 9. The software for processor 21 is stored in ROM memory 22. The information and corresponding type indication adapted by processor 21 are supplied to internal bus 13. Subscription processor 18 checks whether the information from the bus system is of a type which is stored in subscription memory 19. If this is the case, implying that the subsystem requested this type of information, the information in question is stored in a global database memory 24 under control of a global database manager processor 23. The software for processor 23 is stored in a ROM memory 25. Each time new information of the same type becomes available on bus system 8, this information is again stored in global database memory 24 as described above. In this process,

old information of the said type is overwritten if this information originates from the same interface connected to the bus system. If the new information of the said type originates from a different interface, the information in question is stored in a separate memory position in global database memory 24. No overwriting therefore takes place in case of information of the same type originating from different interfaces. Global database processor 23 is suitable to distinguish information originating from different interfaces. This is made possible by providing each interface with an identity generator 26. An identity generator 26 allows processor 21 to add a parameter I to information which is supplied to bus system 8. The parameter I enables origin determination of information within network 6.

The character of a subscription appears from the repeated acceptance of information of a particular type which becomes available on the bus system, as from the moment subsystem 2 made a first request for the relevant information. The character of a subscription also appears from the repeated supply to the bus system of new information generated by a subsystem as from the moment the interface received the first request via the bus system for the supply of the information in question. This process will be discussed below. It is very probable that a subsystem making a first request for information of a particular type will make another request for this information in the near future. In this way, a new request from the subsystem for the information in question can be immediately complied with by supplying the information from the global database memory 24 to the subsystem. In case several interfaces have supplied information of the type in question to bus system 8, all of which is stored separately in memory 24 under control of parameter I, the question arises which information should be supplied to the subsystem when this subsystem makes another request for the information in question.

This problem can be solved by supplementing information with a quality indication of the information in question. This quality indication is also generated by the subsystems. In this example, the quality indication is formed by parameters Q_0 , t_0 and τ , where Q_0 is the instantaneous quality of the information at the moment of production, t_0 is the moment of production and τ a half life of the quality. Parameter τ thus indicates how long it takes before the quality of the information is reduced by half. Parameter t_0 is derived by means of clock 14. Because a situation may change in the course of time, it is possible that information which is a function of this situation changes in the course of time, thus reducing in quality. The quality indication in question is also stored in memory 24. At a new request of the subsystem to supply informa-

tion of a particular type at moment t , processor 23 can select the best information by means of parameters Q_0 , t_0 and τ , on the basis of the formula:

$$Q(t) = Q_0 + \frac{t - t_0}{\tau}$$

Fig. 3 shows an example.

The information originating from interface n has quality parameters $Q_0 = 8$, $t_0 = 0$ and $\tau = 4$, while the information originating from interface m has quality parameters $Q_0 = 4$, $t_0 = 2$ and $\tau = 6$. Fig. 3 shows that the quality Q_n of the information originating from interface 1 is higher than the quality Q_m of the information originating from interface m , as long as $0 < t < 8$. This implies that processor 23 will supply the information originating from interface n if subsystem 2 requests this information at a moment $t < 8$. In case $t \geq 8$, the information originating from interface m will be presented. If $Q_n = Q_m$ the interface will make a random choice. It should be clear that it is also possible to use different quality parameters and different formulas. The formulas may even be a function of parameter l .

Thanks to the subscription service it is possible to realise that a subsystem is immediately supplied with the best information available at the moment the subsystem requests information of the type in question. For special applications it is possible that a subsystem not only requests the information of the best quality but makes a special request for all information of a particular type available at that moment. This enables observations of different sensors to be correlated with each other in order to construct a virtual observation, which subsequently can be presented to the network with a higher degree of quality than the quality of the individual observations.

When a subsystem makes a first request for the supply of information of a particular type, and thus opens a subscription, this type of information is stored upon reception from bus system 8 in the database memory 24, while the information in question is simultaneously presented to subsystem 2. At a subsequent reception of new information of the said type, this information will only be inserted in database memory 24. Supply of this information, which is stored in database memory 24, to the subsystem occurs at a new request from the subsystem for information of the type in question as described above.

A special application is created when subsystem 2 requests a message in case new information of a particular type becomes available in inter-

face 7 via bus system 8. This saves subsystem 2 from having to wait for the information in question and repeatedly making requests for information of the type in question. This implies that subsystem 2 may in the mean time be otherwise engaged because it will be automatically informed when interface 7, belonging to subsystem 2, receives new information of the type in question. A request from subsystem 2 to interface 7 for a message when new information of a particular type becomes available via bus system 8 also implies opening of a subscription if it concerns a first request for the information in question.

At a certain point, subsystem 2 may decide it is no longer interested in information of a particular type. A subscription opened by a first request for the supply of information of a particular type will then be terminated by a stop order generated by the subsystem. Subscription processor 18 recognises the order and erases the subscription for information of the type in question from memory 19. It is also possible that the interface autonomously terminates a subscription in case information of a particular type is received but no longer requested by the corresponding subsystem.

When subsystem 2 makes the first request to corresponding interface 7 for the supply of information of a particular type and thus opens a subscription, bus adapter processor 21 sees to it that this request is also supplied to bus system 8. The same applies to a stop order generated by subsystem 2 or by interface 7. In both cases, parameter l , characteristic of the relevant interface, is supplied to bus system 8. A request for the supply of information or stop order to terminate the supply of information of a particular type, supplied to bus system 8 in an analogous manner by a different interface, is received by bus adapter processor 21 and presented to internal bus 13. Subscription processor 18, in reaction to such a request, sees to it that a subscription is opened for the supply of information of the type in question produced by subsystem 2 to bus system 8, if the subsystem belonging to the interface is capable of producing the information in question. To this effect, subscription memory 19 contains all types of information the relevant subsystem is capable of producing. The request for supply of information of a type which the subsystem is capable of producing is stored in the subscription memory 19. The storage of this request is executed on the basis of the corresponding parameter l for each requesting interface. Subscription processor 18, in reaction to a stop order received from bus system 8, sees to it that the request for the supply of information of the type in question to bus system 8 is erased from subscription memory 19. The erasure of the relevant request is executed for each requesting inter-

face on the basis of the parameter I received together with and belonging to the stop order. Subscription processor 18 sees to it that every time new information of the type in question is produced by subsystem 2, this information is supplied to bus system 8 via processor 21, as long as at least one interface having made a request for information of the type in question is recorded in subscription memory 19. If a request for supply of information of a particularly type is received via bus system 8 for the first time, resulting in the opening of a subscription for supply of information to bus system 8, processor 18 sees to it that the information in question is directly supplied to bus system 8 if this information is already stored in memory 16. Subsequently, the relevant information is supplied to bus system 8 each time subsystem 2 produces new information of the type in question. The information in question is of course accompanied by quality parameters generated by the subsystem and by parameter I generated by the interface. The interfaces making the request for the information in question will accept the information supplied to bus system 8 and further process it as described above.

The database system also has provisions for ensuring that, upon initialisation of the entire system, all subsystems can start producing information. Difficulties could arise if subsystems need each other's information for the production of new information. In that case, these subsystems would have to wait for each other with the production of new information. To prevent this, a subsystem which has just been activated subsequently provides to interface 7 all types of information it is capable of producing. It may happen that a certain type of information is not yet available, e.g. as a result of the dependence described above. In that case, the information of the type in question is supplied anyway, however, with a quality parameter $Q_0 = 0$. The relevant types are stored in subscription memory 19. It can be proven by induction that all subsystems are capable of producing the required information if it is assumed that the database system contains at least one subsystem which, independent of other subsystems, is capable of producing information. It is quite possible that, during the initialisation stage of the database system, requests for information are lost. For instance, a subsystem may not yet be operational during the initialisation stage because the software required for that subsystem has not yet been loaded. Other subsystems, however, may be immediately operational, because the software required for these subsystems is stored in a ROM memory. In case an interface belonging to a subsystem which is not yet operational requests information of a particular type via the bus system, this interface

is not capable of deciding whether this request should be stored in subscription memory 19. This is caused by the fact that it is not yet known which types of information the relevant subsystem is capable of producing. To prevent the loss of such requests for information, during the initialisation stage an interface may store all requests for information of a particular type in subscription memory 19. If, at a certain moment, the software required for the subsystem is loaded, interface 2 can then check which requests for information the subsystem belonging to this interface can ever comply with. This is done on the basis of the information generated by the subsystem during initialisation, if applicable including a quality parameter $Q_0 = 0$. The requests which cannot be complied with are erased. Subsequently, the interface leaves the initialisation stage and stores requests for information of a particular type only if the subsystem belonging to the interface can produce the information in question.

A particularly cost-effective version is created when an interface is provided with an event processor 27 (see Fig. 2). A ROM memory 28 contains the software for event processor 27. Event processor 27 is included in interface 7 with the purpose of recognising special types of information received via bus system 8. The information concerned is of a type which is not regularly generated by a subsystem and supplied to bus system 8. Subsystem 2 will inform event processor 27 in advance concerning the separate types of information that can be processed or can no longer be processed by subsystem 2. An example of this type of information is a fire alarm generated by a subsystem and supplied to interface 7, which supplies it to bus system 8 with priority. After the fire alarm in question is received via bus system 8 by event processor 27, it is with priority supplied to subsystem 2 belonging to the said event processor 27 if subsystem 2 is capable of processing the information in question. Subsequently, the said subsystem can react immediately to the fire alarm. A second example of information recognised by event processor 27 concerns information generated by a monitor processor 29. A ROM memory 30 contains the software for the monitor processor 29. Monitor processor 29 checks the functioning of the database system. If monitor processor 29 discovers that the database system does not function properly, monitor processor 29 generates an alarm signal which is supplied to bus system 8. Upon reception via bus system 8, such a signal is recognised by the event processor 27 and processed as described above.

Monitor processor 29 checks for instance whether a request from corresponding subsystem 2 for information of a particular type results in the reception of this information via bus system 8. If,

after a certain period of time, the relevant information has not been received, while the database system is designed in such a way that each request for information of a particular type can be complied to, this implies that an interface or subsystem in the system does not function properly. Because the identity of the producer of the information in question is not known, nothing can be decided concerning the identity of the malfunctioning interface or subsystem.

This problem can be solved by providing the database system with a special subsystem 2a, which is the only subsystem having full knowledge of the database system configuration (see Fig. 1). An interface which detects malfunctioning of an information producer (subsystem plus corresponding interface), by means of its monitor processor 29 generates a signal which is supplied to bus system 8. The said signal is of such a nature that it is recognised by special subsystem 2a. This subsystem can then take various types of measures. One of these measures could be that subsystem 2a transmits a message reporting the problem. It is however also possible that special subsystem 2a transmits a message initiating an automatic reconfiguration of the database system. This can be achieved by defining special messages, which are recognised by certain event processors 27 of interfaces. This enables special subsystem 2a to address the said interfaces. This is the only case in which addressing techniques are used because special subsystem 2a has knowledge of the system configuration. This however does not harm normal communication among subsystems in which addressing techniques are not used. After all, a special interface is concerned which only produces data in a special situation. An event processor of an interface addressed by the special subsystem subsequently informs the corresponding subsystem of its new task.

A monitor processor 29 has been programmed by means of memory 30 in such a way that monitor processor 29 questions the corresponding subsystem if this subsystem did not interact with the interface during a certain period. If the said subsystem appears to be malfunctioning, the monitor processor may report this to special subsystem 2a. Special subsystem 2a can then take the above-mentioned measures by means of the event processors.

A monitor processor 29 may also check whether the frequency of information of a particular type presented via bus system 8 does not suddenly change. This may be caused by problems in a particular interface. It is very unlikely that the subsystem belonging to this interface is the cause of these problems because the said interface would have recorded this as described above. Monitor

processor 29 in that case transmits a message to the possibly malfunctioning interface. The identity of the possibly malfunctioning interface is known thanks to parameter I, used by the possibly malfunctioning interface in the transmission of information. If the said interface does not react normally, the monitor processor which discovered this may report it to the special subsystem. The special subsystem can then again take the necessary measures as described above.

Claims

1. Database system comprising:

- a) a plurality of subsystems (2i) each of which is adapted to produce and process one or more types of information;
- b) a bus system (8); and
- c) a plurality of interfaces (7i) respectively coupling the respective subsystems (2i) to said bus system (8),

where

- i) each subsystem (2i) comprises means for requesting information by including in such a request an indication of the type of information desired, and means for supplying information produced by said subsystem (2i) including therein an indication of the type of the produced information;
- ii) each interface (7i) comprises means for:
 - sending a request, via the bus system (8), for the supply of a particular type of information in case the subsystem (2i) belonging to the interface (7i) requests information of the said type;
 - accepting information produced by the subsystem (2i) belonging to the interface (7i), including an indication of the type of the information;
 - supplying the bus system (8) with a particular type of information in case the interface (7i), via the bus system (8), receives from another interface (7j) connected to the bus system (8), a request for the supply of information of the last-mentioned type, if the subsystem belonging to the interface (7i) produces the information in question;
 - accepting from the bus system (8) the information of the type requested by the subsystem (2i) belonging to the interface (7i), and supplying the accepted information to subsystem (2i).

characterised in that

iii) each interface (7i) comprises means for:

- storing, as from the moment the subsystem (2i) belonging to the interface (7i) makes at least one request for information of a particular type, the information of the above-mentioned type, each time new information of the said type becomes available on the bus system (8);
- supplying to the bus system (8), as from the moment the interface (7i) receives from the bus system (8) at least one request for the supply of information of a particular type, new information of the said type each time this information is again produced by the subsystem (2i) belonging to the interface (7i);
- supplying already accepted and stored information of a particular type to the subsystem (2i) belonging to the interface (7i) each time the said subsystem (2i) requests information of this type.

2. Database system as claimed in claim 1, characterised in that the interface (7i) is provided with a first memory (24) for the storage of information received via the bus system (8), a first microprocessor (23) controlling the said memory (24), a second memory (16) for the storage of information produced by the subsystem (2i) belonging to the interface (7i), and a second microprocessor (15) controlling the second memory (16).

3. Database system as claimed in claim 1, characterised in that the interface (7i) comprises means for:

- sending a stop order, via the bus system (8) for the cancellation of an earlier request for the supply of information of a particular type, in case the subsystem (2i) belonging to the interface (7i) indicates to this interface (7i) to be no longer interested in the information of the type in question;
- recording each request, made by interfaces (7j) and received via the bus system (8), for the supply of information of a particular type, in case the subsystem (2i) belonging to the interface (7i) is capable of producing the information in question;
- recording each stop order, originating from interfaces (7j) and received via the bus system (8), for the termination of an

earlier request, made by the interface (7j) in question, for the supply of information of a particular type;

- supplying the bus system (8) with information of a particular type in case the subsystem (2i) belonging to the interface (7i) produces this information, as long as at least one request for the supply of the said information has been recorded.

4. Database system as claimed in claim 3, characterised in that the interface (7i) is provided with a third microprocessor (18) and a third memory (19), controlled by this microprocessor (18), to record, for each interface (7j) forming part of the database system, the requests made and stop orders issued by these interfaces (7j) for the supply of information of a particular type, and to record the request made by the subsystem (2i) belonging to the interface (7i) for the supply of information of a particular type.

5. Database system as claimed in claim 3, characterised in that the interface (7i) comprises means for sending a stop order to withdraw an earlier request for the supply of information of a particular type, in case the subsystem (2i) belonging to the interface (7i) does not request the information in question within a certain period of time.

6. Database system as claimed in claims 1 or 3, characterised in that all subsystems (2i) comprise means for the production of a quality indication relating to information produced by the subsystem, and that the interface (7i) belonging to subsystem (2i) is provided with means for:

- simultaneous sending of information of a particular type produced by the subsystem (2i) belonging to the interface (7i), and a quality indication also produced by the said subsystem (2i) and relating to the said information;
- recording and overwriting, for each information-supplying interface (7j), of information of a particular type received via the bus system (8), together with the quality indication belonging to this information;
- supplying the best stored information of a particular type to the subsystem (2i) belonging to the interface (7i), each time the said subsystem (2i) requests this type of information, whereby the best information is selected on the basis of the quality indication.

7. Database system as claimed in claim 6, characterised in that the quality indication mentioned comprises instantaneous quality information Q_0 , durability information r , and moment-of-production information t_0 .

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8. Database system as claimed in claims 6 or 7, characterised in that the interface (7i) comprises the said first memory (24) for the storage of the said quality indication, and the said first microprocessor (23) for the selection of the best information.

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9. Database system as claimed in one of the claims 1-8, characterised in that the interface (7i) provides means for supplying to the subsystem (2i) belonging to the interface (7i) all the already accepted and stored information of a particular type, each time the said subsystem (2i) requests all the information of this type.

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10. Database system as claimed in one of the claims 1-9, characterised in that the interface (7i) provides means for immediately reacting to particular types of information received via the bus system (8), and for immediately supplying this information to the subsystem (2i) belonging to the said interface (7i), and vice versa.

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11. Database system as claimed in claim 10, characterised in that the interface (7i) provides means to react to the said types of information only if the subsystem (2i) belonging to the interface (7i) indicates that it is capable of processing the information in question.

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12. Database system as claimed in claim 11, characterised in that the interface (7i) provides means to inhibit a reaction to the said types of information if the subsystem (2i) belonging to the interface (7i) indicates that it is no longer capable of processing the information in question.

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13. Database system as claimed in claim 10, characterised in that the interface (7i) comprises an event processor (23) with corresponding ROM (28).

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14. Database system as claimed in one of the claims 1-13, characterised in that

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- at least one interface (7i) has facilities for recording of irregular or failing information flows originating from the subsystem (2i) belonging to the interface (7i), and of irregular or failing information flows, received via the bus system (8), originating

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from other interfaces (7j);

- this interface (7j) has facilities for supplying the subsystem (2i) with information relating to the malfunctioning subsystem (2i, 2j) or the malfunctioning interface (7i, 7j).

15. Database system as claimed in claim 14, characterised in that the interface (7i) comprises a monitor processor (29) with corresponding ROM (30).

16. Database system as claimed in claims 13 and 14, characterised in that the said event processor (27) reacts to the information, received via the bus system (8), relating to a malfunctioning interface (7i) or subsystem (2j).

17. Database system as claimed in claim 14, characterised in that

- the database system comprises a special subsystem (2k) which is provided with knowledge concerning the configuration of the database system and is suitable for the generation of database-system-configuring information in case the special subsystem (2k) receives information relating to a malfunctioning interface (7j) or subsystem (2j);
- an interface (7j) comprises facilities to inform the subsystem (2j) belonging to the interface (7j) concerning a new task to be executed by the said subsystem (2j), in conformity with database-system-reconfiguring information received via the bus system (8).

18. Database system as claimed in claims 13 and 17, characterised in that the facilities mentioned in claim 17, comprise the said event processor (27).

19. Database system as claimed in one of the preceding claims characterised in that an initialisation procedure is provided, in which each subsystem (2i) supplies information to the interface (7i) about the types of information it can produce, and that the interface (7i) is provided with means for storing, during the initialisation procedure, requests for the supply of information of a particular type received via the bus system.

Patentansprüche

1. Datenbanksystem, unter anderem bestehend aus:

a) einer Vielzahl von Subsystemen (2i), welche Subsysteme individuell dazu eingerichtet sind, um mehrere Datentypen zu produzieren und zu verarbeiten;

b) einem Bussystem (8); und

c) einer Vielzahl Schnittstellen (7i), welche jeweils die verschiedenen Subsysteme (2i) mit dem erwähnten Bussystem (8) verbinden,

wobei

i) jedes Subsystem (2i) Mittel Datenanforderung umfaßt, welche Anforderung mit einer Indikation über den gewünschten Datentyp versehen wird, und Mittel zur Zuführung der vom erwähnten Subsystem (2i) erzeugten Daten, welche Daten mit einer Indikation über den Typ der produzierten Daten versehen wird;

ii) jede Schnittstelle (7i) Mittel umfaßt, zum:

- über das Bussystem (8) Senden einer Anforderung zur Lieferung von Daten eines bestimmten Typs, wenn das zur Schnittstelle (7i) gehörende Subsystem die Daten des erwähnten Typs anfordert;

- Akzeptieren von Daten, produziert vom zur Schnittstelle (7i) gehörenden Subsystem (2i), inklusive einer Indikation über den Datentyp;

- Versorgen des Bussystems (8) mit einem bestimmten Datentyp, wenn die Schnittstelle (7i), über das Bussystem (8), von einer anderen mit dem Bussystem (8) verbundenen Schnittstelle (7i) eine Anforderung zur Lieferung von Daten des zuletzt erwähnten Typs empfängt, wenn das zur Schnittstelle (7i) gehörende Subsystem die betreffende Daten produziert;

- Akzeptieren durch das Bussystem (8) von Daten des vom zur Schnittstelle (7i) gehörenden Subsystem (2i) verlangten Typs, und Zuführung der akzeptierten Daten zum Subsystem (2i),

dadurch gekennzeichnet, daß

iii) jede Schnittstelle (7i) Mittel umfaßt, zum:

- Speichern, sobald das zur Schnittstelle (7i) gehörende Subsystem (2i) zumindest eine Anforderung nach Daten eines bestimmten Typs abgibt, von Daten des im vorstehenden erwähnten Typs, jedesmal, wenn neue Daten des betreffenden Typs auf dem Bussystem (8) ver-

füßbar werden;

- Zuführen zum Bussystems (8), sobald die Schnittstelle seitens des Bussystems (8) zumindest eine Anforderung nach Daten eines bestimmten Typs empfängt, von neue Daten, jedesmal, wenn diese Daten erneut vom zur Schnittstelle (7i) gehörenden Subsystem (2i) produziert worden sind;

- Zuführen von bereits akzeptierter und gespeicherter Daten eines bestimmten Typs zum zur Schnittstelle (7i) gehörenden Subsystem (2i), jedesmal, wenn das betreffende Subsystem (2i) Daten dieses Typs anfordert.

2. Datenbanksystem gemäß Anspruch 1, dadurch gekennzeichnet, daß die Schnittstelle (7i) mit einem ersten Speicher (24) zur Speicherung von über das Bussystem (8) empfangenen Daten, einem ersten Mikroprozessor (23) zur Steuerung des erwähnten Speichers (24), einem zweiten Speicher (16) zur Speicherung von vom zur Schnittstelle (7i) gehörenden Subsystem (2i) produzierten Daten, und einem zweiten Mikroprozessor (15), zur Steuerung des zweiten Speichers (16), versehen ist.

3. Datenbanksystem gemäß Anspruch 1, dadurch gekennzeichnet, daß die Schnittstelle (7i) Mittel umfaßt zum:

- Senden eines Stoppauftrags, über das Bussystem (8) zur Unterbrechung einer früheren Anforderung zur Lieferung von Daten eines bestimmten Typs, wenn das Subsystem (2i) gehörend zur Schnittstelle (7i) dieser Schnittstellen zu erkennen gibt, kein Interesse mehr an den Daten des betreffenden Typs zu haben;

- Aufzeichnen einer jeden über das Bussystem (8) empfangenen Anforderung durch die Schnittstellen (7i), zur Zuführung von Daten eines bestimmten Typs, wenn das zur Schnittstelle (7i) gehörenden Subsystem (2i) imstande ist, die betreffenden Daten zu produzieren;

- Aufzeichnen eines jeden Stoppauftrags, produziert von Schnittstelle (7i) und über das Bussystem (8) empfangen, zur Unterbrechung einer früheren Anforderung durch die betreffende Schnittstelle (7i), zur Lieferung von Daten eines bestimmten Typs;

- Versorgen des Bussystems (8) mit Daten eines bestimmten Typs, wenn das zur Schnittstelle (7i) gehörende Subsystem

- (2i) diese Daten produziert, solange zumindest eine Anforderung zur Lieferung der erwähnten Daten aufgezeichnet worden ist.
4. Datenbanksystem gemäß Anspruch 3, dadurch gekennzeichnet, daß die Schnittstelle (7i) mit einem dritten Mikroprozessor (18) und einem dritten, von diesem Mikroprozessor (18) gesteuerten Speicher (19), zum Aufzeichnen, für jede Schnittstelle (7j), welche Teil des Datenbanksystems ist, der von diesen Schnittstellen (7j) ausgegebenen Anforderungen und Stoppaufträge zur Lieferung von Daten eines bestimmten Typs, und zum Aufzeichnen der vom zur Schnittstelle (7i) gehörenden Subsystem (2i) durchgeführten Anforderung zur Lieferung von Daten eines bestimmten Typs versehen ist.
5. Datenbanksystem gemäß Anspruch 3, dadurch gekennzeichnet, daß die Schnittstelle (7i) Mittel für das Senden eines Stoppauftrags zum Zurücknehmen einer früheren Anforderung zur Lieferung von Daten eines bestimmten Typs umfaßt, wenn das zur Schnittstelle (7i) gehörende Subsystem (2i) die betreffenden Daten innerhalb eines bestimmten Zeitraumes nicht anfordert.
6. Datenbanksystem gemäß den Ansprüchen 1 oder 3, dadurch gekennzeichnet, daß alle Subsysteme (2i) Mittel zur Erzeugung einer Qualitätsindikation, in bezug auf die vom Subsystem produzierten Daten umfassen, und daß die zum Subsystem (2i) gehörende Schnittstelle (7i) mit Mitteln versehen ist, zum:
- gleichzeitigen Senden von Daten eines bestimmten Typs, vom zur Schnittstelle (7i) gehörenden Subsystem (2i), und einer Qualitätsindikation, ebenfalls vom erwähnten Subsystem (2i) produziert, in bezug auf die erwähnten Daten;
 - Aufzeichnen und Überschreiben, für jede datenanliefernde Schnittstelle (7j), von über das Bussystem (8) empfangenen Daten eines bestimmten Typs, zusammen mit der zu diesen Daten gehörenden Qualitätsindikation;
 - Zuführen der besten, gespeicherten Daten eines bestimmten Typs zum zur Schnittstelle (7i) gehörenden Subsystem (2i), jedesmal wenn das erwähnte Subsystem (2i) Daten dieses Typs anfordert, wobei die besten Daten auf Basis der Qualitätsindikation ausgewählt werden.

7. Datenbanksystem gemäß Anspruch 6, dadurch gekennzeichnet, daß die erwähnte Qualitätsindikation momentane Daten Q_0 über Qualität, Daten τ über Dauerhaftigkeit, und Daten t_0 über Zeitpunkt der Produktion enthält.
8. Datenbanksystem gemäß Anspruch 6 oder 7, dadurch gekennzeichnet, daß die Schnittstelle (7i) den erwähnten ersten Speicher (24) zur Speicherung der erwähnten Qualitätsindikation und den erwähnten ersten Mikroprozessor (23) zur Selektion der besten Daten umfaßt.
9. Datenbanksystem gemäß einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Schnittstelle (7i) eingerichtet ist zur Zuführung zum zur Schnittstelle (7i) gehörenden Subsystem (2i) aller bereits akzeptierten und gespeicherten Daten eines bestimmten Typs, jedesmal, wenn das erwähnte Subsystem (2i) alle Daten dieses Typs anfordert.
10. Datenbanksystem gemäß einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Schnittstelle (7i) Mittel umfaßt zum sofortigen Reagieren auf bestimmte, über das Bussystem (8) empfangene Datentypen, und zum unmittelbaren Zuführen dieser Daten zum zur Schnittstelle (7i) gehörenden Subsystem (2i), und umgekehrt.
11. Datenbanksystem gemäß Anspruch 10, dadurch gekennzeichnet, daß die Schnittstelle (7i) Mittel umfaßt, um auf die erwähnten Datentypen zu reagieren, nur wenn das zur Schnittstelle (7i) gehörende Subsystem (2i) meldet, daß es die betreffenden Daten verarbeiten kann.
12. Datenbanksystem gemäß Anspruch 11, dadurch gekennzeichnet, daß die Schnittstelle (7i) Mittel umfaßt, um eine Reaktion auf die erwähnten Datentypen zu unterdrücken, wenn das zur Schnittstelle (7i) gehörende Subsystem (2i) meldet, daß es die betreffenden Daten nicht länger verarbeiten kann.
13. Datenbanksystem gemäß Anspruch 10, dadurch gekennzeichnet, daß die Schnittstelle (7i) einen Ereignisprozessor (23) mit einem zugehörigen ROM (28) umfaßt.
14. Datenbanksystem gemäß einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß
- zumindest eine Schnittstelle (7i) Mittel zur Aufzeichnung von unregelmäßigen oder fehlenden Datenflüssen umfaßt, welche von dem zur Schnittstelle (7i) gehörenden Subsystem (2i) stammen, sowie

- von unregelmäßigen oder fehlenden, über das Bussystem (8) empfangenen Datenflüssen, welche von anderen Schnittstellen (7j) stammen;
- diese Schnittstelle (7ij) Mittel zum Zuführen von Daten zum Subsystem (2i) umfaßt, welche Daten sich auf das mangelhaft funktionierende Subsystem (2i, 2j) oder die mangelhaft funktionierende Schnittstelle (7i, 7j) beziehen.
15. Datenbanksystem gemäß Anspruch 14, dadurch gekennzeichnet, daß die Schnittstelle (7i) einen Monitorprozessor (29) mit einem zugehörigen ROM (30) umfaßt.
16. Datenbanksystem gemäß den Ansprüchen 13 und 14, dadurch gekennzeichnet, daß der erwähnte Ereignisprozessor (27) auf die über das Bussystem (8) empfangenen Daten reagiert, welche Daten sich auf eine mangelhaft funktionierende Schnittstelle (7j) oder ein mangelhaft funktionierendes Subsystem (2j) bezieht.
17. Datenbanksystem gemäß Anspruch 14, dadurch gekennzeichnet, daß
- das Datenbanksystem ein spezielles Subsystem (2k) umfaßt, welches mit Kenntnis in betreff der Konfiguration des Datenbanksystems versehen und zur Erzeugung von Daten bezüglich Datenbank-Konfiguration eingerichtet ist, wenn das spezielle Subsystem (2k) Daten empfängt, welche Daten sich auf eine mangelhaft funktionierende Schnittstelle (7j) oder ein mangelhaft funktionierendes Subsystem (2j) beziehen;
 - eine Schnittstelle (7j) Mittel umfaßt, um das zur Schnittstelle (7j) gehörende Subsystem (2j) zu informieren, und zwar mit Bezug auf eine neue, von dem erwähnten Subsystem (2j) durchzuführende Aufgabe, entsprechend der über das Bussystem (8) empfangenen, datenbanksystem-rekonfigurierenden Daten.
18. Datenbanksystem gemäß den Ansprüchen 13 und 17, dadurch gekennzeichnet, daß die in Anspruch 17 erwähnten Mittel den erwähnten Ereignisprozessor (27) umfassen.
19. Datenbanksystem gemäß einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß ein Initialisierungsverfahren vorgesehen ist, wobei jedes Subsystem (2i) die Schnittstelle (7i) mit Daten über die von ihm produzierbaren

Datentypen versieht, und daß die Schnittstelle (7i) Mitteln umfaßt, zur Speicherung während des Initialisierungsverfahrens von Anforderungen für die Lieferung von über das Bussystem empfangenen Daten eines bestimmten Typs.

Revendications

1. Système de base de données comprenant :
 - a) un ensemble de sous-systèmes (2i) dont chacun est prévu pour produire et traiter un ou plusieurs types d'informations ;
 - b) un système de type bus (8) ; et
 - c) un ensemble d'interfaces (7i) couplant respectivement les sous-systèmes respectifs (2i) audit système de type bus (8), où
 - i) chaque sous-système (2i) comprend des moyens pour demander des informations en incluant dans une telle demande une indication du type des informations désirées, et des moyens pour fournir les informations produites par ledit sous-système (2i) en y incluant une indication du type des informations produites ;
 - ii) chaque interface (7i) comprend des moyens pour :
 - envoyer une demande, par l'intermédiaire du système de type bus (8), pour la fourniture d'un type particulier d'informations dans le cas où le sous-système (2i) appartenant à l'interface (7i) demande des informations dudit type ;
 - accepter les informations produites par le sous-système (2i) appartenant à l'interface (7i), en incluant une indication du type des informations ;
 - fournir au système de type bus (8) un type particulier d'informations dans le cas où l'interface (7i), par l'intermédiaire du système de type bus (8), reçoit d'une autre interface (7j) reliée au système de type bus (8), une demande pour la fourniture d'informations du dernier type mentionné, si le sous-système appartenant à l'interface (7i) produit les informations en question ;
 - accepter depuis le système de type bus (8) les informations du type demandé par le sous-système (2i) appartenant à l'interface (7i), et fournir au sous-système (2i) les informations acceptées,
- caractérisé en ce que

- iii) chaque interface (7i) comprend des moyens pour :
- mettre en mémoire à partir du moment où le sous-système (2i) appartenant à l'interface (7i) présente au moins une demande pour des informations d'un type particulier, les informations du type mentionné ci-dessus, à chaque fois que de nouvelles informations dudit type deviennent disponibles sur le système de type bus (8) ;
 - fournir au système de type bus (8), à partir du moment où l'interface (7i) reçoit depuis le système de type bus (8) au moins une demande pour la fourniture d'informations d'un type particulier, de nouvelles informations dudit type à chaque fois que ces informations sont à nouveau produites par le sous-système (2i) appartenant à l'interface (7i) ;
 - fournir des informations, d'un type particulier, déjà acceptées et mises en mémoire au sous-système (2i) appartenant à l'interface (7i) à chaque fois que ledit sous-système (2i) demande des informations de ce type.
2. Système de base de données comme revendiqué à la revendication 1, caractérisé en ce que l'interface (7i) présente une première mémoire (24) pour la mise en mémoire d'informations reçues par l'intermédiaire du système de type bus (8), un premier microprocesseur (23) commandant ladite mémoire (24), une seconde mémoire (16) pour la mise en mémoire d'informations produites par le sous-système (2i) appartenant à l'interface (7i), et un second microprocesseur (15) commandant ladite seconde mémoire (16).
3. Système de base de données comme revendiqué à la revendication 1, caractérisé en ce que l'interface (7i) comprend des moyens pour :
- envoyer un ordre d'arrêt, par l'intermédiaire du système de type bus (8), pour la suppression d'une demande antérieure pour la fourniture d'informations d'un type particulier, dans le cas où le sous-système (2i) appartenant à l'interface (7i) indique à cette interface (7i) ne plus être intéressé dans les informations du type en question ;
 - enregistrer chaque demande, effectuée par les interfaces (7j) et reçue par l'inter-

médiaire du système de type bus (8), pour la fourniture d'informations d'un type particulier, dans le cas où le sous-système (2i) appartenant à l'interface (7i) est capable de produire les informations en question ;

- enregistrer chaque ordre d'arrêt, provenant des interfaces (7j) et reçu par l'intermédiaire du système de type bus (8) pour la terminaison d'une demande antérieure, effectuée par l'interface (7j) en question, pour l'amenée d'informations d'un type particulier ;
 - fournir au système de type bus (8) des informations d'un type particulier dans le cas où le sous-système (2i) appartenant à l'interface (7i) produit ces informations, aussi longtemps qu'au moins une demande pour la fourniture desdites informations a été enregistrée.
4. Système de base de données comme revendiqué à la revendication 3, caractérisé en ce que l'interface (7i) présente un troisième microprocesseur (18) et une troisième mémoire (19), commandés par ce microprocesseur (18), pour enregistrer, pour chaque interface (7j) faisant partie du système de base de données, les demandes effectuées et les ordres d'arrêt émis par ces interfaces (7j) pour la fourniture d'informations d'un type particulier, et pour enregistrer la demande effectuée par le sous-système (2i) appartenant à l'interface (7i) pour la fourniture d'informations d'un type particulier.
5. Système de base de données comme revendiqué à la revendication 3, caractérisé en ce que l'interface (7i) comprend des moyens pour envoyer un ordre d'arrêt afin de retirer une demande antérieure pour l'amenée d'informations d'un type particulier, dans le cas où le sous-système (2i) appartenant à l'interface (7i) ne demande pas les informations en question dans une certaine période de temps.
6. Système de base de données comme revendiqué aux revendications 1 ou 3, caractérisé en ce que tous les sous-systèmes (2i) comprennent des moyens pour la production d'une indication de qualité concernant des informations produites par le sous-système, et en ce que l'interface (7i) appartenant au sous-système (2i) est munie de moyens pour :
- envoyer simultanément des informations d'un type particulier produites par le sous-système (2i) appartenant à l'interface (7i), et une indication de qualité également produite par ledit sous-système (2i)

- et concernant lesdites informations ;
 - enregistrer et écraser, pour chaque interface (7i) fournissant des informations, des informations d'un type particulier reçues par l'intermédiaire du système de type bus (8), en même temps que l'indication de qualité appartenant à ces informations ;
 - fournir les meilleures informations, d'un type particulier, mises en mémoire au sous-système (2i) appartenant à l'interface (7i), à chaque fois que ledit sous-système (2i) demande ce type d'informations, de sorte que les meilleures informations sont choisies sur la base de l'indication de qualité.
7. Système de base de données comme revendiqué à la revendication 6, caractérisé en ce que l'indication de qualité mentionnée comprend des informations de qualité instantanées Q_0 , des informations de durabilité τ et des informations de moment de production t_0 .
8. Système de base de données comme revendiqué aux revendications 6 ou 7, caractérisé en ce que l'interface (7i) comprend ladite première mémoire (24) pour la mise en mémoire de ladite indication de qualité, et ledit premier microprocesseur (23) pour la sélection des meilleures informations.
9. Système de base de données comme revendiqué dans une des revendications 1-8, caractérisé en ce que l'interface (7i) présente des moyens pour fournir au sous-système (2i) appartenant à l'interface (7i) toutes les informations d'un type particulier déjà acceptées et mises en mémoire à chaque fois que ledit sous-système (2i) demande toutes les informations de ce type.
10. Système de base de données comme revendiqué dans une des revendications 1-9, caractérisé en ce que l'interface (7i) présente des moyens pour réagir immédiatement à des types particuliers d'informations reçues par l'intermédiaire du système de type bus (8), et pour fournir immédiatement ces informations au sous-système (2i) appartenant à la dite interface (7i), et vice versa.
11. Système de base de données comme revendiqué à la revendication 10, caractérisé en ce que l'interface (7i) présente des moyens pour réagir auxdits types d'informations seulement si le sous-système (2i) appartenant à l'interface (7i) indique qu'il est capable de traiter les

informations en question.

12. Système de base de données comme revendiqué à la revendication 11, caractérisé en ce que l'interface (7i) présente des moyens pour inhiber une réaction auxdits types d'informations si le sous-système (2i) appartenant à l'interface (7i) indique qu'il n'est plus capable de traiter les informations en question.
13. Système de base de données comme revendiqué à la revendication 10, caractérisé en ce que l'interface (7i) comprend un processeur d'évènements (23) avec ROM correspondante (28).
14. Système de base de données comme revendiqué dans une des revendications 1-13, caractérisé en ce que
- au moins une interface (7i) présente des moyens pour enregistrer des débits d'informations irrégulières ou dégradées provenant du sous-système (2i) appartenant à l'interface (7i), et de débits d'informations irrégulières ou dégradées, reçues par l'intermédiaire du système de type bus (8), provenant d'autres interfaces (7j) ;
 - cette interface (7ij) présente des moyens pour fournir au sous-système (2i) des informations concernant le sous-système (2i, 2j) fonctionnant mal ou l'interface (7i, 7j) fonctionnant mal.
15. Système de base de données comme revendiqué à la revendication 14, caractérisé en ce que l'interface (7i) comprend un processeur de contrôle (29) avec ROM correspondante (30).
16. Système de base de données comme revendiqué aux revendications 13 et 14, caractérisé en ce que ledit processeur d'évènements (27) réagit aux informations, reçues par l'intermédiaire du système de type bus (8), concernant une interface (7j) ou un sous-système (2j) fonctionnant mal.
17. Système de base de données comme revendiqué à la revendication 14, caractérisé en ce que
- le système de base de données comprend un sous-système particulier (2k) qui est muni de la connaissance concernant la configuration du système de données et est approprié à la formation d'informations de configuration d'un système de base de données dans le cas où le sous-système particulier (2k) reçoit des

- informations concernant une interface (7j)
ou un sous-système (2j) fonctionnant mal
;
 - une interface (7j) comprend des moyens
particuliers pour informer le sous-système (2j) appartenant à l'interface (7j)
concernant une nouvelle tâche à exé- 5
cuter par ledit sous-système (2j), en
conformité avec des informations de re- 10
configuration d'un système de base de
données qui sont reçues par l'intermé-
diaire du système du type bus (8).
18. Système de base de données comme revendi-
qué aux revendications 13 et 17, caractérisé 15
en ce que les moyens particuliers mentionnés
à la revendication 17 comprennent ledit pro-
cesseur d'évènements (27).
19. Système de base de données comme revendi- 20
qué dans une des revendications précédentes,
caractérisé en ce qu'on prévoit une procédure
d'initialisation dans laquelle chaque sous-sys-
tème (2i) fournit des informations à l'interface 25
(7i) concernant les types d'informations qu'il
peut produire, et en ce que l'interface (7i) est
munie de moyens pour mettre en mémoire,
pendant la procédure d'initialisation, des de-
mandes pour la fourniture d'informations d'un 30
type particulier reçues par l'intermédiaire du
système de type bus.

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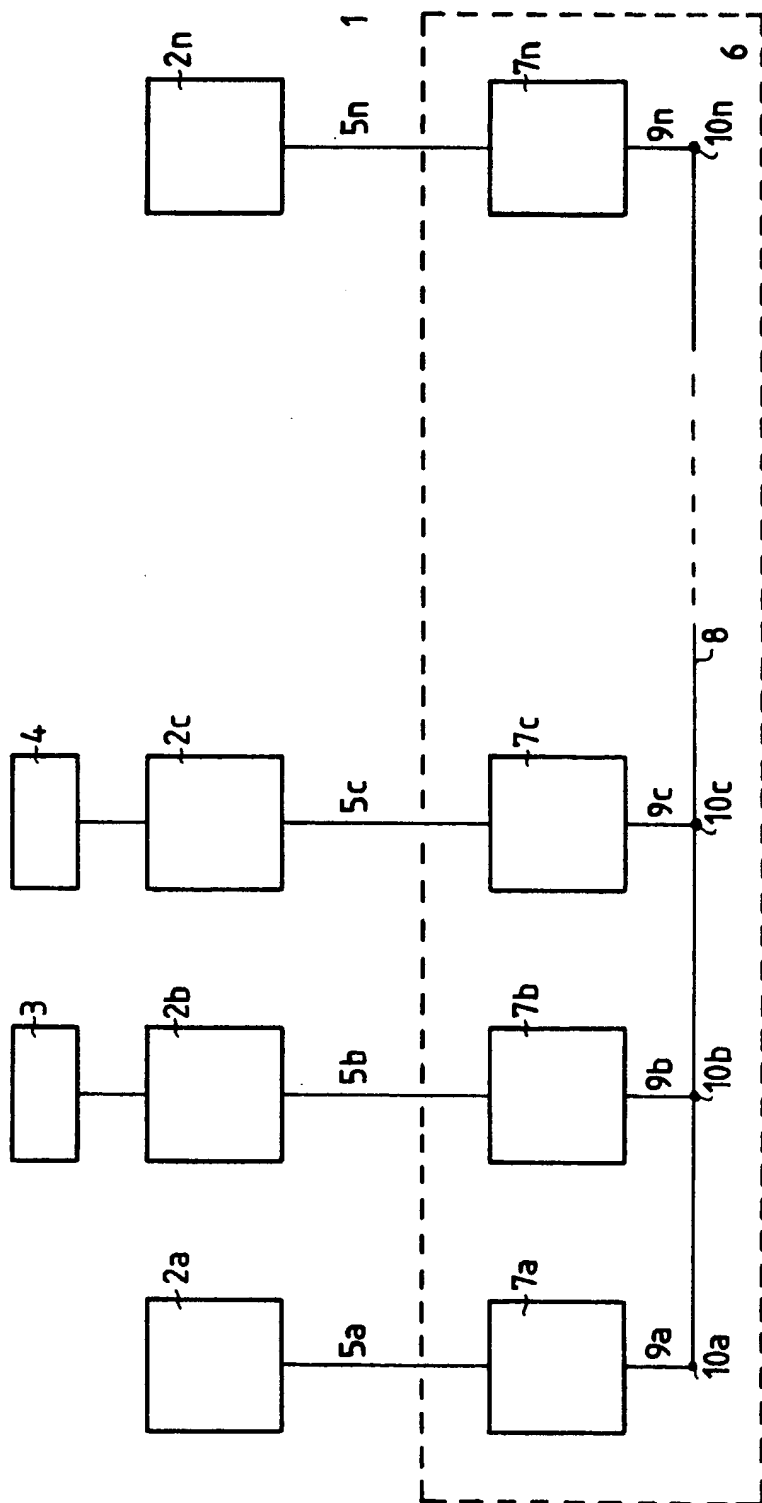


Fig.1

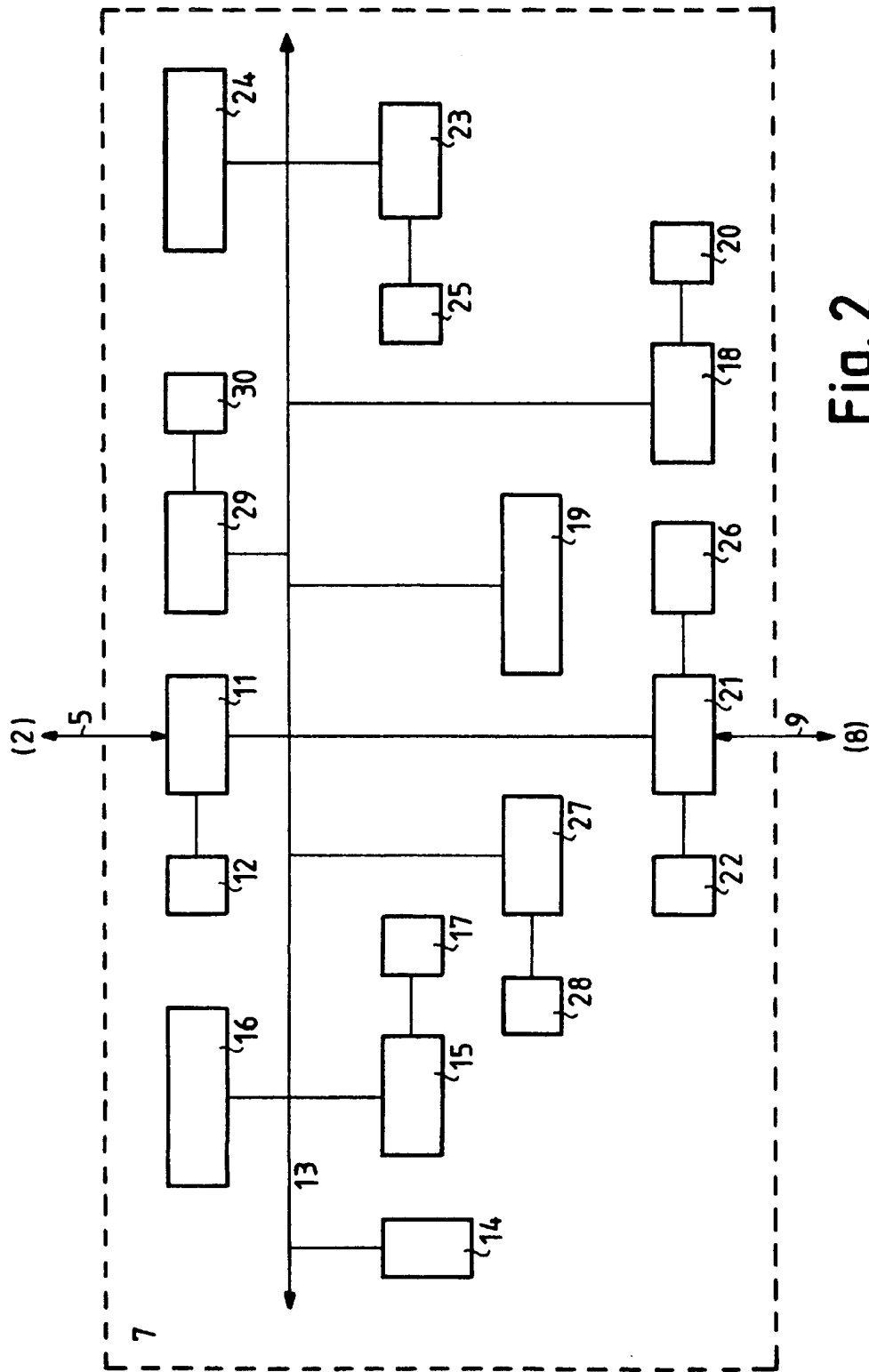


Fig. 2

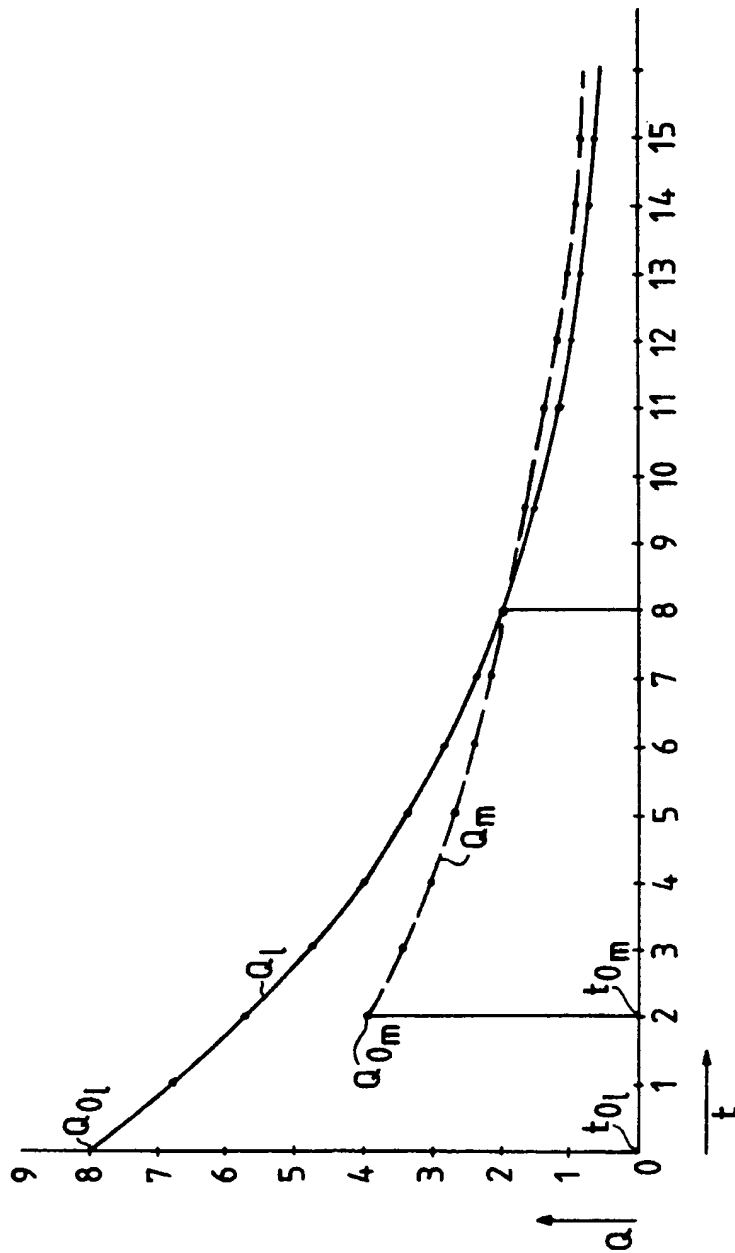


Fig. 3